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Conditions of Sale

As we announced last week, the Council of Ironfoundry Associations has adopted and published for use by *any firm* in the ironfoundry industry "standard conditions of sale." This means that henceforth, no litigant will be able to put forward successfully in a court of law a plea of "custom of the trade." From time to time during the past quarter of a century, we have been asked to give our views as to "custom of trade" in order to help the court to arrive at a fair decision. Such advice was often difficult to give, as conditions varied from district to district. This new document of which thousands are already in use, sets out for the benefit of everybody the terms upon which business is to be transacted in the future. Of real importance are the conditions set out for use of customers' patterns. In future they have to be suited to the needs of the foundry and for fresh ones the "foundry requires to be consulted." This represents a great step forward, but there is now the implied obligation that once having accepted a pattern the foundry must produce decent, saleable castings from it. The letter recently published from an important foundry in the Midlands, stressed the deterioration in the finish of some of the patterns now being received. In future, the action to be taken is quite clear. One of the most contentious points has now been finally settled. From now on, the ironfoundry will not insure customers' patterns against the risk of loss or damage by fire and the like. This is equitable, as the foundry cannot properly assess the value of other people's property. Because of a change in design, a set of patterns which at one time were worth hundreds of pounds, to-day may be almost scrap. Obviously the customer is the best party to effect a proper insurance on his own goods.

The question of the replacement of defective castings has always been contentious and we doubt if finality has yet been reached. The five clauses are excellent, but we still feel, that though it may seem to be the reiteration of the law of the land, there should be a general refusal to pay for any "consequential damages" resulting from the supply of a casting. We recollect a case of where a defective marine engine component was supplied to a firm of ship repairers. Apparently this firm must have given some sort of contractual obligation to hand back the ship to the owners within a specified period. This they failed to do and paid the ship owner some money as the ship could not go on its voyages. Then they sued and obtained from the foundry costs which to the repairers were "agreed damages" but which to the casting manufacturer were obviously "consequential."

Under the "Supplemental Conditions of Sale" is a paragraph on "Tests." In this era of standardisation, there is an ever increasing demand upon the foundry—both ferrous and non-ferrous—to supply castings which will conform to this or that B.S.I. number. The average buyer likes to "cover himself" by quoting what he believes to be an appropriate specification, whether this is or is not essential. In business, where coverage is desired, there is a premium to be paid. Thus, a warning is given, that unless otherwise agreed, the customer must pay for the provision of these test pieces. The main object of the insertion of this clause is, we should imagine, to keep the demand for test bars within reasonable limits.

We regard the publication of these standardised conditions of sale as a real worthwhile step in the progress of the industry and see in them the culmination of a notion long advocated in this column.

Contents

Conditions of Sale, 283.—Forthcoming Events, 284.—A Successful Experiment, 284.—Census of Production, 284.—New Education Film Strips, 284.—A New Specification, 284.—Improvements in Hollow Sticks and Billets by Casting on to Metal Cores, 285.—Copper Puzzle, 294.—Correct Ordering, 294.—Pig-iron and Steel Production in Great Britain, 295.—Personal, 296.—Bolt and Nut Makers' Capital, 296.—News in Brief, 297.—United Kingdom Tin Production, 297.—Company News, 298.—Obituary, 298.—Tin Buying Prices Increased, 298.—New Companies, 300.—Raw Material Markets, 302.

Forthcoming . . . . . Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

APRIL 10.

Institution of Production Engineers (Wolverhampton section):—"Gear Manufacture and Inspection," by F. J. Everest, M.Sc., at Station Hotel, Derby, at 7 p.m.

Institute of Metals:—"New Testing Methods for Metals," by H. J. Curnow, R. A. Mintern, and D. O. Sproule, at 4, Grosvenor Gardens, London, S.W.1, at 7 p.m.

Royal Statistical Society (Tees-side group):—"Use of Statistics in the Solution of Steel Works Problems." Principal speaker: N. H. Bacon. At Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 6.30 p.m.

APRIL 11.

Institute of Welding (South London branch):—"Resistance Welding," by Mr. Railton; "Gas Welding," by Mr. Clarke; "Arc Welding," by Mr. Mulder; "Argon-arc Welding," by Mr. Sillifant. At the Institution of Marine Engineers, London, E.C.3, at 7 p.m.

APRIL 16

Institution of Production Engineers (Birmingham section):—Annual General Meeting, followed by "Developments in Gear Cutting and Finishing Processes," by F. J. Everest, M.Sc., at James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m.

Institute of British Foundrymen

APRIL 12.

West Yorks Branch:—Prize winning Paper in S. W. Wise memorial competition at Technical College, Bradford, at 6.30 p.m.

A Successful Experiment

Just before Easter, the final lecture of a series organised by the Northampton Polytechnic, London, on "Foundry Practice," was given by Mr. R. B. Templeton, managing director of Ealing Park Foundry and Vice-President of the Institute of British Foundrymen. The lecture was announced as the "Marketing of Castings," but, in reality, it was confined to the help afforded by the showing of documentary films. Thus the evening was given over to the exhibition of two films, the first showing the making of a 16-ft. long crankshaft, and the second a general appreciation of the work carried out in a semi-mechanised foundry. The crankshaft, made in core cakes, was for delivery to John Cockerill's, of Liége, and ranks amongst the largest so far made in this country.

As usual, an animated discussion followed and the question now arises as to what is to be done next session. Dr. Garside intends making the Northampton Polytechnic a centre of foundry activities and has asked the group of enthusiastic students, who have attended the course, to write him as to their wishes for next year. Our suggestion is, carry on along exactly the same lines.

New Educational Film Strips

A new series of film-strips covering the basic principles of iron founding is being prepared, and No. 1 is now available. The series covers 10 strips, each dealing with one particular aspect, and an extension to the series may be considered later. The strips are mainly diagrammatic, and each strip covers fully all the essentials of a particular operation, breaking them down into logical sequence and showing, in diagrammatic form, how the operation should be carried out and what are the results of faults at any particular point.

The complete series is as follows:—

(1) Ramming Greensand moulds; (2) mould and core ventilation; (3) cores and core-making; (4) making a simple bench mould; (5) pouring; (6) loam moulding; (7) closing the mould; (8) casting design; (9) machine moulding, and (10) blueprint reading. Each strip is accompanied by full teaching notes, amplifying points in the strip and giving references. The strips have been prepared by Educational Publicity, Limited, London, in collaboration with Newton Chambers & Company, Limited, and the C.F.A. The strips should have a wide field of usefulness.

Film-strip projectors will also be available for supply by the C.F.A., and full details will be given later. The type of film-strip projector is a new one specially adapted for the class of work in mind with a utility interchangeable lamp, and the price at which the C.F.A. will be able to supply is a reasonable one. In the meantime, enquiries are invited from any firm who may have difficulty in obtaining a film-strip lantern. They should be directed to the Secretary of the C.F.A., Derbyshire House, Belgrove Street, London, W.C.1.

Census of Production

On March 18 the Parliamentary Secretary to the Board of Trade announced that it was proposed to shelve the census plans. A pilot census would be taken next year and, in 1949 there is to be a full census in respect of 1948 production. A distribution census is now scheduled for 1950.

It may be assumed that this *volte face* on the part of the Government is, in no small way, due to the industrial clamour against this ill-timed measure. Industry will now be able to go ahead with production and put off the return.

A New Specification

"Pre-formed Thermal Insulating Materials for Central Heating and Hot and Cold Water Supply Installations," just issued by the British Standards Institution under reference B.S. 1,334—1947, is of more than usual interest to foundrymen, as an amelioration in the functions of such apparatus is bound to have a favourable impact on the foundry industry. It costs 3s. 6d. post free from 28, Victoria Street, London, S.W.1.

IMPROVEMENTS IN HOLLOW STICKS AND BILLETS BY CASTING ON TO METAL CORES

By W. T. Pell-Walpole, B.Sc., Ph.D.

Cored sticks and billets of bronzes, brasses, manganese-bronzes, etc., are commonly made by casting the metal into chill moulds with a core made of either sand throughout or of loam plastered on to a thin-walled perforated tube. Either of these types of core is liable to produce a number of typical defects in the casting as follows:—

(1) The slow cooling induced by the sand core tends to aggravate shrinkage porosity, and since cooling proceeds from the chill surface towards the core, the shrinkage porosity and surface "draws" tend to be localised at or near the core surface of the casting.

(2) Gas porosity and attendant inverse segregation may be caused in such castings as a result of the reaction between molten metal and the combined moisture in the sand. This trouble can be controlled and restricted by careful selection of bonding agents and correct baking procedure, but cannot be eliminated entirely.

(3) Rough inner surfaces on cored castings result from penetration of the metal (particularly with the more fluid high-phosphorus bronzes) and sand particles may become fritted on to the metal surface, causing machining difficulties.

(4) Warping and eccentricity, because of the lack of perfect rigidity in sand cores, particularly in cored castings of long narrow section.

It is clear that these defects and difficulties could be avoided if a metal core could be used in place of the sand core. Solid metal cores cannot be used directly, however, since the hollow casting would contract on to the core, either preventing extraction of the latter, or with brittle alloys, causing hot-tearing of the casting. With ductile alloys it has been found possible to use a solid metal core for narrow bore castings, by extracting the core on a draw-bench or press, but such a method is clearly not practicable for the ordinary foundry. The patented Holfos spun-cast process also employs a chill core.

The use of loam-coated hollow metal cores is a compromise solution which at least gives a good measure of rigidity in the core, but retains all the other disadvantages of a sand core, since the loam-coating is relatively thick. This principle has been developed a stage further by the use of solid metal cores coated with pitch or tar for the casting of small bore sticks, but the method cannot be applied to castings requiring a heavier core, since the dressing does not permit sufficient contraction for the core to be extracted after casting.

The Author and his colleagues of the Tin Research Institute have studied the problem of using chill cores, with the object of applying the degassing and slow pouring techniques developed for chill-cast bronze[1-5] to improving the quality of cored sticks and billets.

Experiments with Loam-coated Solid Metal Cores

The contraction of a hollow casting during and after solidification is such that a solid metal core can only be used if it is dressed with a surface layer of a permeable and compressible material which will permit the necessary contraction of the casting without causing the latter to bind firmly on to the core. Since maximum chilling action is desirable in the core, it is essential to use the minimum thickness of surface dressing which will permit easy extraction. The required allowance for contraction varies with the diameter of the casting, so that the material used for the compressible layer must be such that the thickness applied can be varied at will.

Other requirements in the coating material are:—(*a*) It must adhere strongly to the core; (*b*) after baking it must have sufficient strength at high temperatures to withstand the impingement of the stream of metal without fritting or crumbling; (*c*) it must not cause gas absorption by the molten metal, and (*d*) when the casting is solid, the compressed dressing must be sufficiently friable to permit the extraction of the core by tapping with a light hammer.

Loams made from sands or other refractory materials with additions of the necessary bonding agents were an obvious first choice for trial as core-coatings.

Preliminary experiments were made with cast-iron cores 12 in. long and tapering from 1¼ in. to 1⅞ in., coated with a layer of equal parts of ganister and aluminous cement mixed to a fine loam. This could be brushed on to the core and built up to give a strongly adherent coating, providing the core had a slightly roughened surface to provide a keying effect for the loam and was preheated to about 100 deg. C. Higher temperatures cause boiling of the water in the loam which produces a loosely adherent deposit; if the core is much below 100 deg. C., building up the coating to the necessary thickness is unduly prolonged.

The loam is best applied by the method normally used for the preparation of loam-coated hollow cores, *i.e.*, the core is held horizontally on trestles which permit it to be rotated on its own axis, against a scraper board

Casting on to Metal Cores

which is fixed horizontally, and parallel with the axis of the core, and at a distance from the core surface which can be varied according to the thickness of coating required. The loam is applied along the scraper board and the heated core revolving against the edge of the latter picks up a uniform smooth coating.

A minimum thickness of $\frac{1}{16}$ in. of loam coating was required to permit easy extraction of the 1¼-in. core from a casting 2 in. outside diameter, 12 in. long, and it was necessary to bake for at least 2 hrs. at 250 deg. C. to prevent the loam from causing surface blowing on the bore of the casting. When this preliminary experimental procedure had been standardised, cored castings were made in a 15 per cent. tin, 0.7 per cent. phosphorus-bronze, and in a 10 per cent. tin, 2 per cent. phosphorus-bronze. The metal charges were degassed with an oxidising flux (4 per cent. charge of equal parts of copper mill scale, fused borax, sharp sand) and were poured vertically through Salamander tundishes having two pouring apertures diametrically opposite and equidistant between core surface and mould surface. The pouring rate used was the minimum which would fill the mould without cold shuts, since this ensures freedom from shrinkage defects.[3,4] The pouring temperature was 1,200 deg. C.

TABLE I.—*Properties of Cored Sticks in Hard Bronze Alloys Cast with a Chill Core Coated with Alundum/Gannister.*

Ingot Ref. No.	299	300	301	302
Analyses: Tin per cent.	14.8	14.6	9.7	10.4
,, Phosphorus per cent.	0.74	0.72	1.94	2.0
Pouring temperature: deg. C.	1225	1225	1250	1200
,, runner in in.	2 × $\frac{7}{24}$	2 × $\frac{7}{24}$	2 × $\frac{7}{24}$	2 × $\frac{7}{24}$
,, rate: lb. per in.	8	8	8	8
Density cast: Top section, gm./cc.	8.51	8.72	8.38	8.57
,, ,, Lower section, gm./cc.	8.68	8.71	8.30	8.55
,, machined top section, pouring stream	8.59	8.79	8.51	8.61
,, ,, ,, remote from pouring stream	8.30	8.06	8.53	8.57
,, ,, bottom section, pouring stream	8.61	8.66	8.40	8.39
,, ,, ,, remote from pouring stream	8.59	8.65	8.48	8.52
U.T.S. tons/sq. in. Top section, pouring stream	25.1	25.7	24.7	28.3
Elongation: Top section	2	1	2	5
U.T.S. tons/sq. in., Top section, remote from pouring stream	18.5	24.2	28.1	26.7
Elongation per cent.: Top section, remote from pouring stream	1¼	1	4	4
U.T.S. tons/sq. in., Bottom section, pouring stream	23.9	25.3	28.0	29.1
Elongation: Bottom section, pouring stream	1	1¼	5	5
U.T.S. tons/sq. in., Bottom section, remote from pouring stream	24.3	24.1	26.9	29.0
Elongation: Bottom section, remote from pouring stream	1	1¼	2	10
Hardness (D.P.H.) at pouring stream	160	168	168	169
,, ,, remote from pouring stream	154	160	150	150

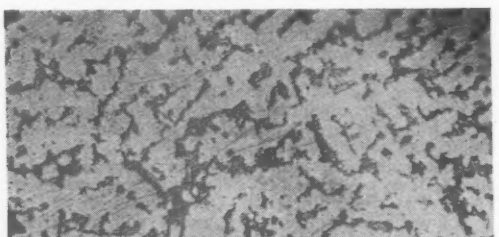

FIG. 1.—HIGH PHOSPHORUS BRONZE CHILL-CAST TUBE WITH LOAM-COATED CORE, 10 PER CENT. SN, 2 PER CENT. P. (× 250.)

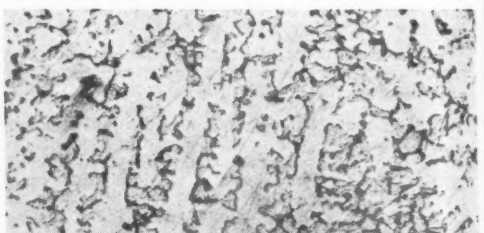

FIG. 2.—SOUND CHILL-CAST TUBE WITH LOAM-COATED CORE, 15 PER CENT. SN, 0.7 PER CENT. P. (× 150.)

TABLE II.—*Characteristics of Refractory Dressings on Chill Cores*

Dressing	Thickness, in.	Core Material	Characteristics of Dressing
Gannister	1/16–1/8	Cast iron ..	Unsuitable, flakes off easily after baking.
,, ...	1/16–1/8	Phos. bronze ..	
,, ...	1/16–1/8	Al. bronze ..	
Alundum/Cement	1/16	Phos. bronze ..	Dressing strong but core difficult to extract.
Alundum/Gannister	1/16	Al. bronze ..	
Alundum/Cement	1/16	Phos. bronze ..	Dressing strong, cores extract easily, but blowing occurs unless baked 1-2 hours at 250 deg. C.
Alundum/Gannister	1/16	Al. bronze ..	
Alundum/Cement	1/32–1/16	Cast iron ..	Unsuitable. Dressing flakes off if allowed to stand on core.
Alundum/Gannister	1/32–1/16		
Sharp red sand, 95 per cent.	1/32	Cast iron ..	Very easily applied. Good adhesion. Very strong—can be filed. Cores extract easily. No blowing with baking ½ hour at 150 deg. C.
Compound A*	1/32	Phos. bronze ..	
	1/32	Al. bronze ..	
Sand/Compound A*	1/32	Cast iron ..	Similar to 5 per cent. but not quite so strong.
Sand/Compound A*, 33 per cent.	1/32	Al. bronze ..	Adhesion not so good as 5 per cent. mixture dressings crack on baking. Unsuitable.
,, ,, 50 per cent.	1/32	Cast iron ..	
Sand/Bentonite, 5 per cent.	1/32	Al. bronze ..	Not quite so good as 5 per cent. compound A*. Extraction of core difficult, but quite practicable. No blowing if baked at 150 deg. C.
	1/32	Phos. bronze ..	
	1/32	Cast iron ..	
Sand/Compound A*, 5 per cent.	1/32	Cast iron ..	Very strong after baking but extraction more difficult than with compound A*. No blowing if baked at 150 deg. C.
Sand/Compound A*, 20 per cent.	1/32	Cast iron ..	Strong, but extraction more difficult than 5 per cent. mixture. Unsuitable.
Sand/Flour, 5 per cent.	1/32	Cast iron ..	Similar, but slightly inferior to 5 per cent. compound A*. Quite suitable. No blowing if baked at about 120 deg. C.
Red sand and Compound B†, 5 per cent. ..	1/32	Cast iron ..	Excellent if baked at 100 deg. C.
Sea sand and Compound B†	1/32	Cast iron ..	Not so strong as last.
Sea sand **Red Sand**	1/32	Cast iron ..	Excellent.
Sea sand/5 per cent. water-glass	1/32	Cast iron ..	Not so strong as last. Must be baked at 430 deg. C. to avoid gassing.
Red sand, Sea sand/5 per cent. water-glass ..	1/32	Cast iron ..	Excellent if baked at 300 deg. C.
Sea sand and 30 to 50 per cent. Alundum ..	1/32	Cast iron ..	Excellent if baked at 300 deg. C.

† Commercial oil/cereal type bond. * Commercial dextrine-type bond.

Quality of the Castings

The cores were extracted readily (1/16-in. coating baked for 2 hrs. at 250 deg. C.) and both inner and outer surfaces of the castings were reasonably smooth and free from visible defects. Density measurements, mechanical tests (Table I) and microstructural examination (Figs. 1 and 2) showed that the castings were very sound and strong compared with similar castings produced in industry by the usual methods (Fig. 3), though slightly inferior to degassed, slow-poured solid sticks cast in the same materials,[5] probably due to slight gas absorption from the loam coating.[6]

Further experience with the gannister-alundum loam on cast-iron cores revealed several disadvantages of this particular combination. Baking conditions were rather critical to ensure freedom from blowing, while if coated cores were baked and allowed to stand prior to use, the coating tended to flake away from the core due to the rusting of the latter. The use of bronze or aluminium-bronze for cores cured the second trouble, but it was decided to test other materials for coating with the object of (*a*) reducing the baking time without increasing the extent of gassing, and (*b*) obtaining a cheaper mixture.

The materials tested (see Table II) were mixtures of either Bromsgrove red sand or sharp sea sand with bonding additions of clay, cereal, or oil types. Cored sticks of 2B8 bronze were prepared from degassed melts with the various core dressings, using much shorter baking times than those employed with the gannister/alundum core-coat. The characteristics of the coatings are summarised in Table II and the mechanical properties and density of some of the castings produced are given in Table III.

The outer surfaces of the castings were in general smooth and free from visible defects. The inner sur-

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TABLE III.—*Properties of Cored Sticks in* 2B8 *Bronze. Cast with Sand-coated Chill Cores.*
Note.—P and R indicate specimens taken from pouring stream (P) and remote from this (R).

Ingot Ref. No.	Analysis.		Pouring conditions.			Core.		Density.			Tensile Properties.				D.P. Hardness.		
						Baking conditions.					P.		R.				
	Sn, per cent.	P, per cent.	Temp. deg. C.	Hole size in in.	Rate, lb./min.	Temp., deg. C.	Time, hrs.	Whole cast.	P.	R.	U.T.S. per sq. in.	El, per cent.	U.T.S. per sq. in.	El, per cent.	Inner surface.	Centre.	Outer surface.
313*	10.7	0.77	1,200	8 × ½	12	150	½	8.57	8.44	8.42	24.8	10	23.2	6	P 123 R 110	127 105	121 104
314	—	—	1,200	,,	12	150	½	8.58	8.65	8.46	26.7	14	23.2	8	P R		
315†	—	—	1,200	,,	12	150	½	8.53	8.49	8.47	24.8	15	23.5	12	P R		
316	10.5	0.89	1,150	2 × ⅞	8	150	½	8.59	8.64	8.46	29.0	20	23.3	8	P 121 R 105	109 119	103 115
317	10.3	0.78	1,200	,,	8	150	2	8.50	8.50	8.37	21.2	7	21.3	6	P 112 R —	112 —	119 —
318	—	—	1,250	,,	7	150	½	8.53	8.67	8.59	21.6	5	21.3	5	P 109 R		
319	10.2	0.79	1,200	2 × ½	12	150	½	8.64	8.64	8.51	26.8	12	22.7	7	P 109 R 121	109 113	100 114
320	10.0	0.76	1,200	,,	12	150	½	8.56	8.65	8.46	23.4	7	21.6	6	P 121 R 109	122 101	115 101
321	—	—	1,250	,,	12	150	½	8.65	—	—	26.1	16	22.0	8	P R		
322	—	—	1,250	,,	12	150	½	8.62	8.60	8.64	24.8	9	21.2	7	P R		
323	—	—	1,200	,,	12	300	2	8.53	8.62	8.56	26.4	14	23.1	6	P R		
324	10.5	0.77	1,200	,,	12	250	½	8.63	8.66	8.59	24.5	9	21.4	5	P 117 R 117	104 118	114 101
325	9.8	0.74	1,200	,,	12	200	½	8.65	8.63	8.80	20.5	4	21.3	5	P 115 R 121	105 131	108 134

* Dressing 313, 5 per cent. Bentonite/sand.
† Dressing 315, 3 per cent. commercial dextrine-type of bond.
All other ingots cast with dressing 5 per cent. commercial dextrine-type of bond.

faces did not vary appreciably with the different loams used, but were very sensitive to core-baking temperature. Baking at 150 deg. C. gave the smoothest surfaces, while baking above 250 deg. C. tended to cause some roughening. In no test was any blowing or shrinkage defect found on the inner face, and such irregu-

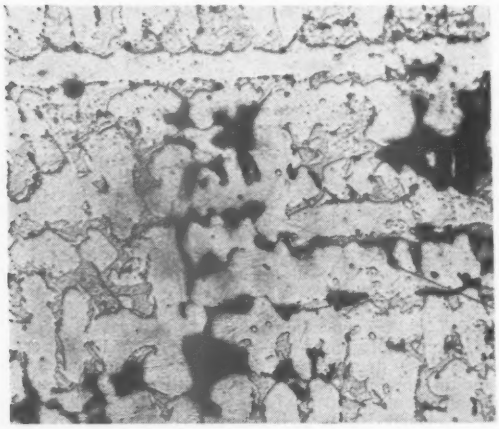


FIG. 3.—POROUS SAND-CAST CORED BILLET, 15 PER CENT. SN, 0.7 PER CENT. P. (× 150.)

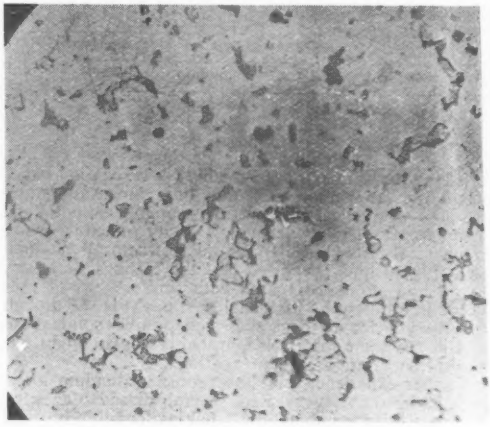


FIG. 4.—SOUND INTERIOR OF TUBE SECTION; LOAM-COATED CORE; 2B8 BRONZE, 10.5 PER CENT. SN, 0.7 PER CENT. P. (× 250.)

TABLE IV.—*Properties of Cored Sticks 3 in. External Diameter, 2¼ in. bore, 1 ft. Long, in Gunmetals and 2B8 Phosphor-bronze, Cast with Chill Cores Coated with 95 per cent. Red Sand, Commercial Dextrine-type of Bond.*

Property tested.	Position of test piece.	88/10/2 Gun-metal.	86/7/5/2 Gun-metal.	85/5/5/5 Gun-metal.	2B8 Bronze.
Density ..	Pouring stream 1	8.69	8.67	8.78	—
	,, ,, 2	—	8.68	8.72	—
	Remote 1 ..	8.66	8.67	8.61	—
	,, 2 ..	—	8.60	8.62	—
Tensile strength, tons/sq. in.	Pouring stream 1	18.5	16.8	19.3	24.5
	,, ,, 2	—	16.8	18.3	24.5
	Remote 1 ..	18.3	16.3	16.8	20.3
	,, 2 ..	—	15.9	15.5	20.2
Elongation per cent. on 2 in.	Pouring stream 1	9	6	26	6
	,, ,, 2	—	10	20	8
	Remote 1 ..	9	7	18	4
	,, 2 ..	—	6	14	8
Ingot Ref. No. ..	—	424	425	426	427

larities as occurred could be removed by machining away a surface layer $\frac{1}{32}$ in. deep. The only exceptions were tubes which were cast at too low a temperature. These showed fine pinholing on machined or fractured surfaces. Fractured surfaces of other tubes were free from visible defect.

Microstructures showed fine grain with uniformly distributed compounds and freedom from porosity (Fig. 4), except for a shallow zone up to $\frac{1}{16}$ in. deep beneath the core surface, apparently caused by local gas absorption from the loam dressing.

Density and Tensile Values

Density and tensile values confirm that there is appreciable porosity present as compared with solid sticks cast similarly, but the values are much superior to those normally obtained with cored sticks made with sand cores. The hardness values were also noticeably more uniform across the wall section (see final column, Table III) than is usually obtained with cored castings.

A further series of tests made on castings 12 in. long by 3-in. external dia. by 2¼-in. bore, in 2B8 bronze and in three popular gunmetals, using chill cores with red sand and a commercial dextrine type of bond, prepared as before, gave similar results (Table

TABLE V.—*Effect of Casting Conditions on the Properties of Chill-cast Cored Billets. 9 per cent. Sn, 1.5 per cent. P Hard Bronze. Loam-coated Core*

Mould.	Core.	Funnel holes.	Pouring temp., deg. C.	Density.	Pouring stream specimen.		Remote specimen.		Remarks.	Ref. No.
					U.T.S.	El, per cent.	U.T.S.	El, per cent.		
Bronze chill	Solid with thin alundum wash	2×$\frac{11}{16}$	1,100	8.69	30	28	29	17	Core dressing too thin. Did not strip	459
,, ,, ...	,, ,,	,,	,,	8.60	29	35	31	40	As cast, annealed for test	460
,, ,, ...	Solid, with thicker alundum wash	2×$\frac{1}{16}$	,,	8.72	25	7	22	6	Difficult to strip ..	461
,, ,, ...	Solid, with 100 gms. alundum coat	2×$\frac{1}{16}$	1,150	8.60	26	6	22	5	Gassed. Stripped easily	462
,, ,, ...	Solid, with 170 gms. alundum coat	2×$\frac{1}{16}$	1,100	8.50	24	13	22	14	Stripped easily, but gassed	463
,, ,, ...	Solid with 85 gms. compound B*/sand dress	2×$\frac{1}{4}$	1,100	8.68	27	5	25	5	Difficult to strip ..	464
,, ,, ...	Solid with 170 gms. compound B*/sand dress	,,	,,	8.59	25	5	22	7	Stripped easily, but gassed	465
,, ,, ...	,, ,,	,,	,,	—	25	14	25	10	As cast but annealed ..	466
,, ,, ...	Solid with 80 gms. compound B*/sand dress	4×$\frac{1}{16}$	1,150	8.53	27	14	25	14	As cast, but annealed. Stripped, trace of gassing	467
Steel ring in green sand	,, ,,	2×$\frac{1}{4}$	1,100	8.52	22	7	24	11	Gassed by green sand at base of tube	468
Bronze chill	Solid with 80 gms. sand/water-glass coat	4×$\frac{1}{16}$	1,100	8.54	25	14	24	10	Stripped, no visible bleeding	469
,, ,, ...	Solid, alundum/sea sand coat	2×$\frac{1}{4}$	1,050	8.50	24	11	24	10	Stripped, no visible bleeding	470
Steel chill	,, ,,	,,	1,100	8.49	24	15	22	12	,, ,,	471
Bronze chill	,, ,,	4×$\frac{1}{32}$	1,050	8.49	30	20	26	11	,, ,,	472
,, ,, ...	,, ,,	,,	1,100	8.55	28	15	25	11	,, ,,	473
,, ,, ...	,, ,,	,,	1,200	8.38	22	10	24	13	Severe bleeding ..	474
Steel ring in green sand	,, ,,	2×$\frac{1}{16}$	1,080	8.58	27	24	26	19	No bleeding	475
,, ,,	,, ,,	,,	,,	8.26	21	9	19	5	Gassed by green sand..	476
,, ,,	,, ,,	4×$\frac{1}{4}$	1,120	8.47	28	17	25	11	No bleeding	477
,, ,,	,, ,,	2×$\frac{1}{16}$	1,200	8.49	25	15	22	5	Severe bleeding ..	478
Chill bronze	Sheet steel tube ..	2×$\frac{1}{4}$	1,150	8.60	26	11	24	7	No bleeding	479
,, ,, ...	Sheet dressed tallow/charcoal	2×$\frac{1}{16}$	1,150	8.60	29	6	25	11	,, ,, ...	480
,, ,, ...	Sheet dressed alundum wash	,,	,,	8.58	28	21	26	19	,, ,, ...	481
,, ,, ...	Sheet dressed tallow/charcoal	,,	1,100	8.58	28	26	23	13	Incomplete filling at remote position	482

Casting on to Metal Cores

IV). The gunmetals showed good mechanical properties and very little gas porosity, but the 2B8 bronze showed rather more gassing than in the smaller castings, probably due to the greater core surface/casting volume. In order to obtain greater control over this gas absorption from the loam, an extensive investigation of this problem was then undertaken. Detailed results published previously[6] showed that the extent of gas absorption was determined by the following factors:—

(1) The amount of sand with which the metal comes into contact.

(2) The nature and concentration of the bonding agent. Oil bonds gassed least, cereal bonds next and clay bonds worst.

(3) The mechanical grade of the sand—the finer the grade the more violent the gassing, due to decreased permeability and increased clay content.

(4) The *combined* water content of the sand mixture, determined by baking conditions. Maximum air circulation was required, together with a baking temperature of not less than 200 deg. C. for organic bonds and not less than 300 deg. C. (preferably 600 deg. C.) for clay bonds.

(5) The temperature attained at the sand/metal interface, determined mainly by the pouring temperature—the higher the temperature the greater the gas absorption.

(6) Composition of the bronze. Gas absorption increases rapidly with phosphorus content, slightly with tin content or with zinc content (up to 5 per cent.) and decreases with lead content.

In the light of these findings, further tests were made on cored billets, 5-in. external dia., 3½-in. internal dia., with several loam coatings, baked at the temperatures determined in the preceding investigation. The alloys used were 9 per cent. tin, 1.5 per cent. phosphorus, and 10 per cent. tin, 0.75 per cent. phosphorus, since these compositions are very prone to gas absorption from the sand/metal reaction, due to their high phosphorus contents. Various rates and temperatures of pouring were used (as shown in Tables V and VI).

From the results (summarised in Tables V and VI) it was concluded that, with both alloys, greatest soundness and strength are obtained with the lowest pouring temperature at which it is possible to fill the mould. Pouring rate has relatively little effect, but multiple pouring streams give better properties than using only two, probably due to the reduction in the temperature reached at the sand/metal interface, with consequent reduction in the degree of gas absorption.

A loam consisting of equal parts red sand and sea sand with 5 per cent. commercial oil and cereal bond (baked at 200 deg. C.) is most suitable for the 2B8 metal, but with the high-phosphorus alloy, a 50/50 mixture of sea sand with aluminous cement (baked at 300 deg. C.) gives the best results.

This process has since been applied with considerable success for cored sticks up to 2 ft. long with cores 1 to 3 in. dia., but was found to be difficult to apply to long narrow cores (2 ft. 9 in. by ½ in. to 1 in. dia.), due to the rapid chilling of the preheated core when the wet loam was applied. Large cored castings (10 to 12 in. external dia. and 6 to 8⅜ in. internal dia.) were also less satisfactory, since the thick layer of loam required caused considerable gassing. Further investigations were undertaken to meet the requirements of these special cases.

TABLE VI.—*Properties of Chill-cast Cored Billets* (10 *per cent. Tin*, 0.7 *per cent. Phos.*). *Cast on Loam-coated Cores.*

Ref. No.	Mould.	Core.	Funnel holes.	Pouring temp. deg.C.	Density.	Pouring stream.		Remote specimen.		Remarks.
						U.T.S. Per cent.	El. Per cent.	U.T.S. Per cent.	El. Per cent.	
487	Chill bronze ..	Solid, sand/commercial oil/cereal bond coat	4 × ¼	1,150	8.69	26	18	23	13	No gassing.
488	Chill bronze ..	Solid, sea/sand/alundum coat	4 × ¼	1,150	8.54	23	15	23	15	Slight gassing.
489	Chill bronze ..	Solid, sea-sand/alundum coat	4 × ¼	1,100	8.54	17	4	23	11	,, ,,

Experiments with Asbestos-wrapped Cores

A substitute for a loam coating, particularly for long narrow cores, must be in such a form that it can be applied to the core without heating the latter. It must also have the necessary refractoriness, mechanical strength and compressibility and must not cause excessive "gassing" of the casting. Asbestos paper was selected for trial as being most likely to meet these requirements. It was found that paper of thickness 0.01 or 0.015 in. could be wrapped on to a cold metal core without cracking, and could be sealed on, either with water, or preferably with a weak solution of dextrine or other gum.

The compressibility of the paper was determined by immersing a sheet 0.015 in. thick into a pot of molten bronze, and allowing the bronze to solidify on to it and to cool to normal temperature. The thickness of the compressed layer of paper measured by a travelling microscope was found to be 0.0075 in. The contraction of a solid bronze casting in cooling from the solidus to normal temperatures (a range of about 700 deg. C.) is 0.015 in. per inch. Thus, to allow for this contraction without imposing undue stress on the casting, the thickness of the asbestos layer must be 0.015 in. per inch dia. of the casting, *i.e.*, one layer of paper 0.015 in. thick (two thicknesses in the diameter) should permit the required degree of contraction.

Castings, from 2 to 5 in. external dia., ¼ to 3½ in.

core dia., 6 in. to 2 ft. 9 in. long, were poured slowly from degassed 2B8 bronze, using asbestos-wrapped cores prepared as above. The wrapped cores were baked at 150 deg. C., and, when solid, the castings were quenched in cold water and allowed to soak for five minutes.

In all cases the calculated thickness of asbestos wrapping was satisfactory for easy extraction of tapered cores ($\frac{1}{16}$ in. per foot length), but with long parallel cores twice the calculated thickness was necessary. The inner surfaces of all castings were smooth and true, but the outsides and upper surfaces showed some tin

lated spirits, or in water with the addition of suitable wetting and bonding agents, were selected for test, together with various refractory washes and commercial core-coat preparations, and cored sticks of 2B8 bronze were prepared as before, using asbestos-wrapped cores dressed lightly with these preparations. The castings were examined for visual signs of gassing and the bulk density of each was determined (Table VII). The refractory dressings tended to increase rather than decrease the extent of gas absorption; the commercial core-coat gave a slight improvement in this respect, but the best results were obtained with suspensions of

TABLE VII.—*Tests with Asbestos Wrapped Chill Cores (Tapered $\frac{1}{16}$ in. per 1-ft. length, Except where Otherwise Stated) in 2B8 Castings, 2 in. External Diameter.*

Layers of paper.	Top dressings and core details.	Baking ½ hr. Deg. C.	Outer surface of casting.	Inner surface of casting.	Extraction of core.	Tube density.
2	None. Compound A* bound	200			Very easily	8.48
2	" " "	300	Good	Good	"	8.58
1	" Parallel core	250	"	Excellent	Difficult "	8.55
1	" Water bound	200	"	Good	"	8.57
1	" "	300	"	"	Easily	8.60
2	" "	150	"	Excellent	"	8.48
2	Aluminium/alundum	200	"	Good	"	8.47
2	Thin alundum	200	"	"	"	8.41
2	Aluminium/alundum	300	Rough	"	"	8.58
2	10 per cent. Compound A*/10 per cent. Aluminium/water	250	Moderate	Moderate	"	8.60
2	" " " " "	200	Good	Good	"	8.57
2	Aluminium paint (Otopose)	200	"	"	"	8.63
2	Aluminium-Linseed oil	200	Tough	Excellent	Very easy	8.68
2	Aluminium/Compound A*/Alundum	200	Excellent	"	"	8.52
1	" " "	250	Good	Good	Easy	8.63
1	" " "	300	"	"	"	8.71
1	1 per cent. Compound A*, 5 per cent. Aluminium/water	300	Excellent	Excellent	"	8.72
1	1 per cent. Alundum, 5 per cent. Aluminium/water	300	Good	"	"	8.63
1	1 per cent. Compound A*, 5 per cent. Aluminium/water	250	"	"	"	8.69
1	Aluminium-Linseed oil	250	"	"	"	8.61
1	2 per cent. Compound A*, 5 per cent. Aluminium/water	250	Excellent	"	"	8.69
1	Proprietary core coat	250	"	"	"	8.59
1	2 per cent. Compound A*, 5 per cent. Aluminium parallel core	300	Good	Good	"	8.72
1	" " " "	250	"	"	"	8.70
1	Resin/Aluminium/Meths core	250	"	"	"	8.60
1	Aluminium/Paraffin core	250	Rough	"	"	8.65
1	5 per cent. Compound A*/5 per cent. Aluminium/water	250	"	"	"	8.55
1	Aluminium paint	250	"	"	"	8.68
1	Meths/Shellac/Tartaric acid/ Aluminium, par. core	250	"	"	"	8.58

* Compound A is a commercial dextrine-type bond.

sweat, apparently caused by gas absorption from the asbestos. This was confirmed by density measurements. The castings with double the calculated thickness of asbestos were gassed more severely than the tapered castings prepared with the thinner wrappings. In further experiments the extent of gassing was appreciably reduced, but not eliminated, by increasing the core-baking temperature from 150 to 300 deg. C. (see Table VII).

Surface Dressings to Reduce Gas Absorption

Experiments were then made to develop a surface dressing for the asbestos, which would reduce the extent of gas absorption. The Author's successful use of mould dressings containing aluminium powder for preventing the gas reaction responsible for " blowing " in chill castings,[7] indicated that some similar dressing applied to the asbestos paper might prevent gas absorption by the bronze from this source.

Suspensions of aluminium powder in oils, in methy-

aluminium powder. Of these, the dressings in which an oily or resinous substance was the carrier, tended to cause severe charcoal traps on the *outer* surface of the castings, but the suspensions of aluminium powder in water with small additions of a dextrine-type of bond were free from defect and gave good resistance to gas absorption. A minimum aluminium content of 5 per cent. was required to prevent gassing, and 2 per cent. of this proprietary material was the minimum addition for easy " wetting " and good adhesion. Higher concentrations of aluminium caused some entrapping of aluminium powder in the casting, while appreciably higher concentrations of the dextrine bond caused a reappearance of gassing, probably due to the reaction of the dextrine itself with the bronze. The mechanical properties of some 2B8 castings made with asbestos-wrapped cores are given in Table VIII.

This process, employing the wrapped core, dressed with a suspension of 5 per cent. aluminium powder with 2 per cent. dextrine bond, and baked at 300 deg.

E

Casting on to Metal Cores

C., has been adopted with considerable success by a number of foundries for the production of cored sticks up to 2 to 3 ft. long, with cores ½ to 2 in. dia. in bronze and other copper alloys, but with heavier castings it has been found that the greater thickness of asbestos wrapping required to facilitate extraction, causes gas absorption in high phosphorus bronzes, even when the aluminium dressing is used.

Further experiments were then undertaken to modify the process for heavy castings.

Split Chill Cores with Asbestos Inserts for Heavy Castings

For cored castings of 3-in. internal dia. or over, it was found possible to dispense with the asbestos wrapping by splitting the core into halves (for 3-in. to 4-in. dia only), or preferably into quarters, removing the required thickness of metal from the radial faces and inserting baked asbestos paper compression layers to allow for the contraction of the casting. Aluminium paint is used on the core as well as on the mould. This procedure isolates the asbestos from the molten metal except for the thickness of the compression layers; these can be isolated if necessary by wrapping the asbestos layer in copper foil, though in practice this made no appreciable difference.

Castings made with this split core in high-phosphorus bronze had properties superior to any made by the former processes, and were almost equal in strength and soundness to solid billets made by the same process (Table IX).

The procedure has since been successfully adopted by one foundry for the production of cored 2B8 castings, 12-in. external dia., 8-in. internal dia. These castings gave average densities of 8.70, with tensile strength averaging 27 tons per sq. in., associated with an elongation of 40 per cent.

Comparative Tests on Loam-coated, Asbestos-wrapped and Split-core processes

The Author's colleague, Mr. J. C. Prytherch, M.Sc., has carried out some comparative tests on the several new chill processes and on the older sand-core processes, for the production of cored billets (6 in. high, 6-in. external dia., 4-in. core dia.) containing 9 per cent. tin, 1.5 per cent. phosphorus. The results, summarised in Table IX, show the general superiority of the new processes, the split-core modification giving the best results for castings of this size.

Recommended Procedures for Using Chill Cores

From the results of these investigations, it is recommended that the asbestos-wrapped core process should be used for cored sticks with cores up to 2¼-in. dia., and the split-core process for castings requiring thicker cores. For either type, bronze should be de-gassed by melting under an oxidising flux (1 part copper-mill scale, 1 part sea sand, and 1 part either of fused borax or of a lead-free glass). The flux must be removed before casting and, when scrap or ingot charges have been melted, the necessary additions made for oxidation losses (*e.g.*, approximately ½ per cent. tin, 0.2 to 0.3 per cent. phosphorus for 2B8 bronze; 0.5 per cent. tin, ½ per cent. zinc for gunmetals, and 0.5 per cent. tin, 1 per cent. lead for leaded bronzes).

The bronze must be top-poured through a preheated moisture-free refractory nozzle (*e.g.*, made either of Salamander or Slix). The pouring rate is given by the formula $R = KD$, where R is the rate in lb. per min., K a constant depending on phosphorus content, D is

TABLE VIII.—*Properties of Cored Sticks in 2B8 Bronze (10.5 per cent. Tin, 0.7 per cent. Phos.), Cast on Asbestos-coated Chill Cores.*
P = Specimen from position of pouring stream.
R = Specimen from position remote from pouring stream.

Core covering.	Bulk density.		Density round circumference. (as cast).						Tensile properties around circumference, U.T.S. in tons per sq. in., elongation per cent.						Mean Density (gms/cc)	Mean U.T.S. (Tons. per sq. in.)	Mean El. per cent.
	Top.	Bottom.	R_1	P_2	R_3	R_4	P_5	R_6	R_1	P_2	R_3	R_4	P_5	R_6			
Two layers asbestos paper	8.55	8.60	8.67	8.68	8.70	8.68	8.62	8.67		25.0 12 per cent.	21.6 6 per cent.	22.2 7 per cent.	20.5 5 per cent.	22.8 5 per cent.	8.67	22.4	7
As above, protected with Al. powder and seal oil	8.61	8.67	8.65	8.76	8.70	8.73	8.69	8.65	x20.8	22.7 8 per cent.	24.5 9 per cent.	22.4 7 per cent.	23.2 11 per cent.	20.6 7 per cent.	8.70	22.4	8
One layer asbestos protected with Al. powder and commercial dextrine type bond	8.70	8.74	8.71	8.71	8.78	8.73	8.73	8.73	x23.4	22.2 16 per cent.	24.4 3 per cent.	24.8 10 per cent.	23.5 6 per cent.	25.0 8 per cent.	8.74	24.8	9
	Mean density (gm. per cc.)				Mean U.T.S. (in. per sq. in.)						Mean El. Per cent.						

the sum of the internal and external diameter of the casting. K should be taken as 6 when phosphorus is less than 0.25 per cent 5 for 0.5 to 1 per cent. P, and 4 for between 1.5 and 2 per cent. P. The number of streams should be two for castings up to 2-in. dia., four up to 4-in. dia., six up to 8-in. dia., and 12 for larger castings.

For cores up to 2½-in. dia. up to 3 ft. long, wrap with asbestos paper (0.015 in. thick), allowing one complete wrapping per 1-in. thickness of the core, which should be smooth-surfaced and tapered $\frac{1}{16}$ in. on dia. per foot length. For parallel cores, double this thickness is required. The paper must be sealed

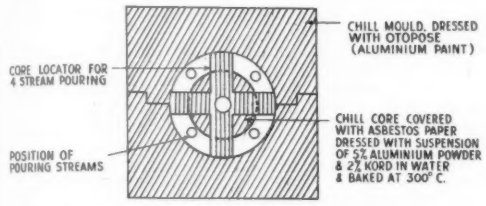

CHILL MOULD, DRESSED WITH OTOPOSE (ALUMINIUM PAINT)
CORE LOCATOR FOR 4 STREAM POURING
CHILL CORE COVERED WITH ASBESTOS PAPER DRESSED WITH SUSPENSION OF 5% ALUMINIUM POWDER & 2% KORD IN WATER & BAKED AT 300° C.
POSITION OF POURING STREAMS

FIG. 5.—CHILL MOULD SET-UP FOR SLOW POURING CORED STICKS 2 IN. EXTERNAL DIA., 1 IN. BORE, WITH ASBESTOS WRAPPED CHILL CORE.

on to the core, with a suspension of 5 per cent. aluminium powder in a 2 per cent. solution of dextrine-type gum in water; this also acts as the core-coat. The coated core must be baked for not less than 15 min. at 300 deg C. before use. A typical mould set-up for this process is shown in Fig. 5.

After the casting has solidified and cooled to about 300 deg. C., it should be stripped, and quenched in water and allowed to stand for five minutes. The core should then tap out readily. Cores of diameter

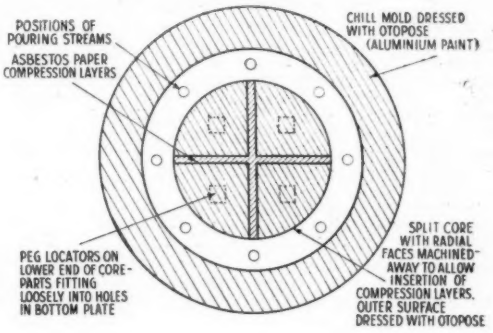

POSITIONS OF POURING STREAMS
ASBESTOS PAPER COMPRESSION LAYERS
CHILL MOLD DRESSED WITH OTOPOSE (ALUMINIUM PAINT)
SPLIT CORE WITH RADIAL FACES MACHINED AWAY TO ALLOW INSERTION OF COMPRESSION LAYERS. OUTER SURFACE DRESSED WITH OTOPOSE
PEG LOCATORS ON LOWER END OF CORE-PARTS FITTING LOOSELY INTO HOLES IN BOTTOM PLATE

FIG. 6.—MOULD SET-UP FOR SLOW POURING CORED BILLET WITH SPLIT CHILL CORE.

greater than 2½ in. should be split vertically into four uniform sections and a cut taken from each radial face of 0.015 in. per in. of core diameter. The four sections are then heated to about 100 deg. C., dressed with resinous aluminium paint, set up in the mould with asbestos paper inserts (previously baked at 300 deg. C.), as shown in Fig. 6. When the casting has cooled to approximately 300 deg. C., the one-quarter of the core may be tapped out, so releasing the others.

TABLE IX.—*Comparison of Cored Billets (9 per cent. Tin, 1·5 per cent. Phos.), 6 in. High by 6 in. External dia. by 3½ in. Internal diam. Cast with Sand, Loam-coated Chill, Asbestos-wrapped Chill, and Split-chill Cores, respectively.*

Core.	Properties of casting.		
	Mean* density, Gm./cc.	Mean* U.T.S. Tons per sq. in.	Mean* El. Per cent. on 2 in.
Gum-bound sand, baked 250 deg. C.†	8.42	22.5	10
Sea-sand bonded with commercial dextrine-type bond	8.55	26.6	16
Red sand bonded with aluminous cement, baked 300 deg. C. ..	8.55	26.5	14
Chill, coated with 50/50 sea sand/aluminous cement	8.58	27.0	15
Chill core with asbestos wrapping	8.55	25·0	12
Split chill with asbestos inserts ..	8.62	27.7	20
Solid billet for comparison ..	8.62	30.5‡	45‡

* Mean of 16 tests on vertical specimens.
† Sample core from an industrial foundry.
‡ The solid billet cools more slowly and tensile properties are improved due to this partial annealing treatment.

Acknowledgments

This work was carried out in collaboration with the Tin Research Institute, and the Author wishes to thank Mr. J. C. Prytherch, M.Sc., F.I.M., who has assisted with the experimental work and carried out industrial-scale tests in several foundries. Thanks are also due to C. L. Hill, of Willenhall; J. Tome, Birmingham; to Engineering Requisites, Limited, Croydon; and to Mr. H. C. Tuck, of Dualloys, Croydon; for co-operation in applying these methods to normal foundry production.

REFERENCES

1 W. T. Pell-Walpole, J. Inst. Metals, 1944, **70**, 127.
2 W. T. Pell-Walpole and V. Kondic, J. Inst. Metals, 1944, **70**, 275.
3 W. T. Pell-Walpole, J. Inst. Metals, 1945, **71**, 37.
4 K. Winterton, J. Inst. Metals, 1945, **71**, 581.
5 W. T. Pell-Walpole, "Metallurgia," June, July, 1946.
6 W. T. Pell-Walpole, FOUNDRY TRADE JOURNAL, January to February, 1946.
7 W. T. Pell-Walpole, "Metal," Industry August 16, 1946.

Copper Puzzle

By "Onlooker"

The upward movement in American commodity prices which appeared to have culminated in December, inasmuch as some recession followed, appears now to be under way again and the past few weeks have seen quite a sharp advance in more than one direction. This is particularly disappointing as the trend in December was downwards and it was hoped this would continue. Non-ferrous metals have certainly been very firm, and although the producers are credited with a desire to check this upward surge, their efforts, have certainly been in vain. Copper has climbed to 22¼ cents per pound f.a.s. New York, which has a sterling equivalent of about £127 per ton and would amount to, say £132 if ocean freight and delivery charges to consumers' works here are added.

In lead, the gap between the ruling price in the U.K. and the parity of the U.S. quotation is even more marked, for across the Atlantic the figure is 15 cents, equal to £84 per ton against £70 in the U.K. That is the situation at the time of writing, but it is anticipated that at any moment there will be an advance to £85.

Zinc is in a more stable position and it hardly seems as if we shall see any change, although under a system of bulk purchasing, it is not easy to know what is going to happen.

Even at £70 lead has set up a record high price, and should a further advance take place, the contrast with the previous best will be even more marked. In copper it is necessary to go back thirty years to the time of the first world war to match the present price, and it may be noted in passing that in the interim period, the quotation has only once stood above £100, that being in 1929 when Copper Exporters Inc. had matters all their own way.

Even so this exalted level lasted for only about three weeks and the market settled down for a twelvemonth at £84, until in April, 1930, it slumped overnight by £18 to £66. The cause of this setback was the accumulation of stock, for output had been greatly encouraged by the favourable price level while consumption was retarded.

To-day, this has not happened—yet—but there can be little doubt that a day of reckoning lies ahead of us, in spite of all talk about values of necessity ruling higher in this post-war era due to increased costs of production. Too much stress should not be laid on the U.S. February copper statistics showing a reduction of 26,000 short tons in deliveries to consumers, for the probability is, not that their needs were less, but that the additional copper required was not forthcoming from the national reserve stocks.

One of the most interesting developments in copper at the present time is the movement in the U.S.A. towards suspending the 4 cents import duty which has been in force for the last 15 years or so. The Bill to ensure a suspension of this tariff has been passed by the House of Representatives and now has to go to the Senate, but there seems to be a fairly general ex-

(*Continued at foot of next column.*)

Correct Ordering

By "Tramp"

From time to time considerable sums of money are wasted because of someone's lack of appreciation that the term "cast iron" covers a wide variety of materials possessing different properties.

For example, a pattern of a tray approximately 4 ft. long and 2 ft. wide was sent to a foundry with an order "2 off cast iron." This tray was duly moulded and cast in a good class machinery iron, in which the general run of castings in the foundry were normally produced. Some time after despatch, the customer complained to the foundry that the trays supplied were unsuitable, and would someone call around and see the job.

On calling at the customer's plant, the representative of the foundry was amazed to find that these trays were being used in an annealing furnace, and because of repeated heating and cooling had "grown" considerably until it was impossible to get them through the doorway.

Here was a case of insufficient information being supplied when ordering. If it had been specified for what purpose these trays were to be used they could have been made from a suitable grade of metal, which would have been immune from growth.

A similar case occurred at another foundry, where a pattern for apparently a bracket, about 8 ft. long and 1 ft. deep, was received, together with an order for "8 off cast iron." These, too, were treated as the trays, and after a period, complaints were received of their unsuitability. In this case the castings were the iron work on which a brick bed was built for use in a metallurgical furnace for roasting ore, and the heat of the furnace had caused the castings to distort unduly and disturb the brickwork, necessitating the complete rebuilding of this rotary hearth.

Such experiences serve to emphasise the necessity for definite information being given with an order, or if this is not supplied initially, for the foundryman to ascertain from his client the exact nature of the job before casting the components, and thus ensure that the best grade of metal is used for the job, and that no undue waste occurs.

(*Continued from previous column.*)

pectation that it will go through and that the period of free entry of copper may be as much as two years. This will certainly have a marked effect on the situation and it is likely to strengthen the present price trend in acting as a prop to the quotation outside the United States, for foreign countries will be able to find a ready market there. This is likely to accentuate the scarcity of metal in the Old World, and so long as American activity persists, we must expect that the price will rule high. But the question is, how long will that last, and how much of the present buying is due to anxiety on the part of users to get some metal behind them? It is very hard to say, but all interested in copper will be well advised to study every move in the game during the coming weeks and months.

Pig-iron and Steel Production in Great Britain

Statistics for December, 1946

The following particulars relating to pig-iron and steel production in Great Britain have been extracted from the Statistical Bulletin for January, 1947, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and ferro-alloys in December, with the number of furnaces in blast at the end of the month; Table II, production of steel ingots and castings in December; and Table III, deliveries of alloy and non-alloy finished steel. Table IV summarises the activities of the steel industry as a whole during the six months ended December, 1946.

TABLE I.—*Weekly Average Production of Pig-iron and Blast-furnace Ferro-alloys in December*, 1946. (*Thousands of Tons.*)

District.	Furnaces in blast, 26.12.46	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	26	—	15.8	20.0	1.7	—	37.5
Lancs. (excl. N.W. Coast), Denbigh, Flints and Ches.	5	—	6.0	—	—	0.7	6.7
Yorkshire (incl. Sheffield, excl. N.E. Coast							
Lincolnshire	13	—	19.7	—	—	—	19.7
North-East Coast	26	5.6	31.0	0.4	—	1.8	38.8
Scotland	11	0.6	8.6	2.8	—	—	12.0
Staffs, Shrops., Worcs. and Warwick.	5	—	3.5	1.1	—	—	4.6
S. Wales and Monmouthshire	6	2.9	17.2	—	—	—	20.1
North-West Coast	7	13.1	—	0.1	—	0.6	13.8
Total	99	22.2	101.8	24.4	1.7	3.1	153.2
November, 1946	98	21.2	102.6	26.1	1.4	2.6	153.9
December, 1945	99	21.0	99.3	20.3	1.4	3.5	145.5

TABLE III.—*Weekly Average Deliveries of Alloy and Non-alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1945.	1946.	1945.	1946.	
			Dec.	Nov.	Dec.
Non-alloy Steel :—					
Heavy rails, sleepers	7.1	9.0	10.3	7.6	7.6
Heavy and med. plates	26.4	30.9	28.3	34.4	29.4
Other heavy products	33·1	31.9	29.0	33.9	29.3
Light rolled products (excl. wire rods and alloy steel bars)	41.9	48.9	39.7	55.7	46.2
Ferro-concrete bars	1.8	3.2	2.0	3.1	2.4
Cold-rolled strip	4.0	4.2	3.3	4.9	4.1
Bright steel bars	3.9	4.5	3.2	5.2	4.4
Sheets, coated and uncoated	20.2	22.4	17.8	23.4	20.6
Tin, terne, blackplate	9.5	10.4	9.5	12.3	11.7
Tubes and pipes	10.9	14.0	11.6	16.0	13.7
Steel wire	10.2	11.8	9.2	12.6	10.9
Tyres, wheels and axles	2.5	3.4	3.1	3.8	3.5
Forgings	5.3	4.9	4.4	5.5	5.0
Castings	4.1	2.9	2.7	3.3	2.9
Total	180.9	202.4	174.1	221.7	191.7
*Alloy steel :—**					
Plates	1.1	0.3	0.6	0.2	0.1
Tubes and pipes	0.3	0.2	0.2	0.4	0.4
Bars, sheets, strip and wire	3.0	2.9	2.3	3.8	3.2
Forgings	2.2	1.6	1.4	1.9	1.7
Castings	0.9	0.6	0.5	0.5	0.5
Total	7.5	5.6	5.0	6.8	5.9
Total U.K. production†	188.4	208.0	179.1	228.5	197.6
Less Intra-industry conversion	17.8	16.4	15.2	20.1	11.8
Total net U.K. deliveries	170.6	191.6	163.9	208.4	185.8
Add Deliveries of imported finished steel	1.0	—	0.1	—	—
Total deliveries of finished steel	171.6	191.6	164.0	208.4	185.8

* Excludes high-speed steel.
† Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in December*, 1946. (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.*		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
			(Basic)					
Derby, Leics., Notts., Northants and Essex	—	—	9.5	1.0	0.3	10.4	0.4	10.8
Lancs. (excl. N.W. coast), Denbigh, Flints. and Ches.	0.7	18.1	—	0.4	0.4	18.8	0.8	19.6
Yorkshire (exc). N.E. coast and Sheffield)								
Lincolnshire	—	18.5	—	—	0.1	18.5	0.1	18.6
North-East Coast	3.0	46.7	—	0.5	0.4	49.4	1.2	50.6
Scotland	6.5	31.4	—	1.0	0.7	38.0	1.6	39.6
Staffs., Shrops., Worcs. and Warwick	—	10.0	—	0.5	0.5	10.1	0.9	11.0
			(Basic)					
S. Wales and Monmouthshire	6.2	35.9	4.6	0.7	0.1	47.2	0.3	47.5
Sheffield	7.4	17.8	—	5.7	0.4	30.0	1.3	31.3
			(Acid)					
North-West Coast	0.1	3.5	3.8	—	0.1	7.2	0.1	7.3
Total	23.9	181.9	17.7	9.8	3.0	229.6	6.7	236.3
November, 1946	27.8	202.8	19.1	10.8	3.2	256.3	7.4	263.7
December, 1945	21.8	170.9	18.4	7.9	2.6	215.9	5.7	221.6

* Including alloy.

(*Continued at foot of page* 296.)

Personal

MR. D. LION CACHET has been elected president of the South African Association of Production Engineers.

SIR HORACE HAMILTON has been elected chairman of the Imperial Economic Committee for the year 1947-48.

SIR PERCY MILLS, MR. A. P. H. AITKEN and MR. G. A. PHILLIPS have joined the board of Textile Machinery Makers, Limited.

MR. F. CLARK has been appointed a director of Thomas Blackburn & Sons, Limited, structural and general engineers, etc., of Preston.

MR. BEN THORNTON has been appointed assistant to the managing director of the Wellman Smith Owen Engineering Corporation, Limited. MR. W. H. DAY has been appointed secretary.

SIR HAROLD HARTLEY, a past president of the British Cast Iron Research Association and the Institute of Vitreous Enamellers, has been appointed chairman of the British Overseas Airways, Limited.

DR. E. P. ANDREAE has resigned from the board of A. C. Wickman, Limited, machine-tool makers, of Coventry. LORD ABERCONWAY, MR. S. W. RAWSON and MR. E. MENSFORTH have been elected to the board.

MR. EDWARD CAMDEN FRYER has been appointed a director of Josiah Parkes & Sons, Limited, Willenhall, Staffs. He has been connected with the company in various technical capacities since 1922, and has been works general manager for the past year.

DR. GEORGE L. KELLEY has been appointed deputy chairman of the Pressed Steel Company, Limited, on his resignation from the post of managing director. MR. A. L. SHUTTLEWORTH has been appointed managing director and MR. MICHAEL L. BELLHOUSE assistant managing director.

MR. JOHN MCVICAR, who went to Rugby 11 years ago as erecting shop superintendent to the English Electric Company, Limited, and became works superintendent two years later, has been appointed production manager in the engineering department of John Brown & Company, Limited, Clydebank.

CAPT. B. H. PETER, who will retire on September 30 next, has relinquished, as from March 25 last, his appointment as managing director of the Westinghouse Brake & Signal Company, Limited, and becomes deputy chairman. MR. D. F. BROWN has been appointed to succeed Capt. Peter as managing director.

MR. PERCIVAL PHILLIPS, secretary to Samuel Osborn & Company, Limited, steel and tool manufacturers, of Sheffield, retired last week after having completed 50 years' service with the company. He is succeeded by MR. F. MAY, who joined the company in 1916 as assistant cashier. He has been assistant secretary since 1940.

BREVET COL. HAROLD BANTOCK SANKEY, managing director of Joseph Sankey & Sons, Limited, and a director of Guest, Keen & Nettlefolds, Limited, Harris & Sheldon, Limited, and John Lysaght, Limited, and LT.-COL. WILLIAM ERNEST GIBBONS, a director of Gibbons (Dudley), Limited, have been appointed Deputy-Lieutenants of Staffordshire.

SIR EDWIN NOEL PLOWDEN has been appointed Chief Planning Officer in connection with the interdepartmental planning staff which is to be set up by the Government. Sir Edwin is a director of C. Tennant, Sons & Company, Limited, steel agents and merchants of refractory materials and exporters, and of British Aluminium, Limited, and the B.S.A.A. Corporation, Limited.

Will

MARTYN, S. T., of Penarth, Glam, iron-ore importer ... £75,619

Bolt and Nut Makers' Capital

The directors of Warne, Wright & Rowland, Limited, makers of bolts, screws and small engineering parts, of Birmingham, have recently acquired the goodwill, properties, etc., of a business. This necessitates the raising of further capital and the directors have resolved to issue *pro rata* to the existing ordinary shareholders 135,150 ordinary shares of 2s. each at the price of 7s. 4½d. per share in the proportion of one such share for each four ordinary shares held on March 28, 1947, ignoring fractions. The shares now issued will not rank for any dividend declared in respect of the year ended December 31, 1946, but will otherwise rank *pari passu* with the existing ordinary shares.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from page 295.*)

TABLE IV.—*General Summary of the Pig-Iron and Steel Industry.* (*Weekly Averages in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			Steel stocks held by producers, etc.*
					Imports.	Output of ingots and castings.	Deliveries of finished steel.	
1938	228.1	89.2	130.0	117.9	16.2	200.0	—	—
1945	272.5	77.2	136.7	138.5	2.9	227·3	171·6	1,683.9
1946	234·1	115.4	149.3	147.0	8.3	244.1	191.6	1,189.7
1946—July	220.3	119.4	147.0	137.5	6.5	226.1	176.6	1,160.6
August	223.6	118.9	145.3	134.9	10.2	226.0	172.9	1,198.9
September	229.3	118.4	147.3	144.8	13.3	238.5	207.7	1,186.8
October	230.2	126.3	155.8	153.6	10.8	254.3	209.1	1,103.9
November	221.7	127.3	153.9	160.0	8.7	263.7	208.4	1,068.5
December	216.7	125.7	153.2	143.9	4.9	236.3	185.8	1,042.6

* Stocks at the beginning of the years and months shown.

News in Brief

MOST FOUNDRIES in Eire are working only one day each week owing to fuel shortage.

SWAN, HUNTER & WIGHAM RICHARDSON, LIMITED, are to launch on May 6 the light fleet aircraft carrier "Albion" (18,300 tons).

JOHN DALGLISH & SONS, engineers, textile-machinery makers, etc., of Pollokshaws, Glasgow, have just celebrated their 75th anniversary.

SIR ARTHUR SMART, who addressed the Institution of Metallurgists at Birmingham recently, took for his subject "The Place of the Metallurgist in Industry." Sir Arthur is director of the metals division of Imperial Chemical Industries, Limited.

EMPLOYERS IN THE chain trade are to be asked to inaugurate a profit-sharing scheme. This was decided at the recent annual meeting of the Chain Makers and Strikers' Association at Cradley Heath, when it was also decided to apply for the five-day week of 44 hours for the hand-welded section. An application for a 15 per cent. advance in wages because of the poor quality of iron and fuel was agreed upon.

BRECKNELL, MUNRO & ROGERS, LIMITED, engineers and non-ferrous founders, of Bristol, propose to increase their capital from £95,000 to £150,000 by the creation of 275,000 ordinary shares of 4s. each, 40,000 of which would be offered to ordinary stockholders at 22s. 6d. a share in the proportion of one new share for every 10 held. Plans of the company include the transfer of the foundry from the main works to Swinford and the provision of centralised office accommodation at the main works.

AN APPEAL BY THE Inland Revenue against a decision of the Court of Appeal that, in computing for the purpose of excess profits tax the capital of the Northern Aluminium Company, Limited, a sum of £2,743,469 paid by the company in 1943 to the Ministry of Aircraft Production under an agreement for reduction of prices in 1941 did not constitute an "accruing liability" of the company in 1941 and was therefore not to be deducted from the capital employed by the company, was dismissed by the House of Lords last week.

AN EXHIBITION OF INDUSTRIAL DESIGN will be held in Edinburgh in August and September under the auspices of the Scottish Committee of the Council of Industrial Design. It will be staged in the Royal Scottish Museum, with supplementary displays in shop windows in Princes Street. The exhibition will not be a trade fair and space will not be sold. The exhibits will be chosen from goods submitted to selection committees appointed by the Scottish Committee, and these selection committees will be advised in each case by persons of commercial experience and technical knowledge.

A SCHEME OF AMALGAMATION has been effected between the Hackbridge Electric Construction Company, Limited, the Hewittic Electric Company, Limited, and the New Switchgear Construction Company, Limited, which have been closely associated for some time past. The new company, with a capital of £750,000, has taken over all the assets, liabilities and functions of the three companies and will operate under the title of the Hackbridge & Hewittic Electric Company, Limited. The directors of the three companies are continuing with the amalgamated company and all business will continue to be carried out in the same factories as hitherto.

AN INTERIM STATEMENT by Mr. John R. Govett, the chairman, to members of the Zinc Corporation, Limited, and New Broken Hill Consolidated, Limited, states that agreement has been entered into under which the Zinc Corporation has sold at cost to New Broken Hill Consolidated 10 per cent. of its annual ore production as from January 1, 1946, and until total lead contents of the ore so sold and delivered reaches 30,000 tons. Assuming the present production programme of the Zinc Corporation is realised, this obligation should be fulfilled at or before the end of 1949. Thereafter, the Zinc Corporation has the right to purchase a similar tonnage on similar terms from New Broken Hill Consolidated.

FEW FIRMS could have been hit more hardly by the fuel crisis than we have, say Mr. W. E. Gibbons, chairman, and Mr. T. Allen, managing director, in a statement circulated with the annual accounts of Gibbons (Dudley) Limited, manufacturers of gas retorts, etc. After a total stoppage at all their works of two weeks, they are still receiving less than half their normal supply of coal, and, since their production is directly proportionate to the fuel they burn, that production must drop in like ratio. At half output they make a heavy loss. Delays in the supply of the refractory material they make, and of other materials, must also adversely affect the profits made on contracts carried out by their subsidiary, Gibbons Bros., Limited, the statement adds.

United Kingdom Tin Position

The Ministry of Supply has released the following figures showing the United Kingdom tin position for the month of February:—

		Ministry.	Consumers.
		Long tons.	Long tons.
TIN METAL:			
Stocks at February 1	.. ..	7,974	3,910
Arrivals		—	—
Production		2,872	—
		10,846	3,910
Deliveries:			
To U.K. consumers..	.. 2,075	—	2,075
For export	.. 259	2,334	—
		—	5,985
Consumption	..	—	1,888
Stocks at February 28 ..	..	8,512	4,097*
TIN ORE (Tin content):			
Stocks in U.K. at February 1	..	7,731	—
Stocks in U.K. at February 28	..	6,456	—

* Calculated. Reported 3,863 tons.

Company News

(Figures for previous year in brackets.)

Joseph Lucas—Interim dividend of 2½% (same).

Textile Machinery Makers—Dividend of 6% (same).

Economic Gas Boiler Company—Dividend of 20% (10%).

Heenan, Beddow & Sturmey—Dividend of 15% (same).

Webley & Scott—Dividend of 15% (same and bonus of 10%).

Dunswart Iron & Steel Works—Interim dividend of 6% (4%).

C. & W. Walker—Dividend of 10% (same) and bonus of 2½% (nil).

Cochran & Company Annan—Interim dividend of 1½%, tax free (same).

Telegraph Construction & Maintenance Company—Final dividend of 5%, making 10% (same).

Charles Neil & Company—Final dividend of 25% (50%), tax free, making 50% (same), tax free.

Anderston Foundry Company—Payment of 50%, tax free, from accumulated and undistributed profits.

Manganese Bronze & Brass Company—Final dividend of 22½% (17½%), making 30% (25%).

Lanarkshire Steel Company—Net profit for 1946, £101,369 (£61,578); to depreciation, £63,000 (£40,000); directors' fees, £600 (same); dividend of 15% (12½%); forward, £55,744 (£42,312).

Humphreys—Profit to November 30, £51,406 (£40,627); to tax, £24,034 (£22,045); dividend of 15% (12½%) and bonus of 2½% (nil); to general reserve, £25,000 (same); forward, £24,800 (£35,079).

Metropolitan Electric Cable & Construction Company—Net profit for 1946, £77,624 (£33,354); to tax, £53,000 (£14,000); deferred repairs, £2,500 (nil); final dividend of 10% (same), making 15% (same); forward, £65,311 (£48,137).

Worthington-Simpson—Net profit for 1946, after E.P.T., depreciation, etc., £122,124 (£50,692); to income tax provision, £58,000 (£23,090); general reserve, £25,000 (£5,000); dividend of 20% (10%); forward, £33,521 (£32,856).

J. W. Singer & Sons—Net profit for the 11 months ended December 31, £11,975 (£7,572 for the year); dividend of 75% (dividend of 10% and victory bonus of 10%); to general reserve, £10,000 (nil); forward, £23,875 (£31,695).

Newey & Tayler—Dividends from subsidiary companies and sundry receipts, less expenses, for 1946, including balance brought forward, £46,920 (£32,508); final dividend of 7½%, making 10% (same) and cash distribution of £9,101 from capital profits; forward, £19,819.

G. D. Peters & Company—Net profit, after income tax, for 1946, £74,574 (£38,590); transfer to staff reserve, £5,000 (same); general reserve, £50,000 (£20,000 to dividend equalisation reserve); final dividend of 7½% and bonus of 2½%, making 17½% (same), forward, £43,691 (£38,735).

R. W. Crabtree & Sons—Trading profit for 1946, after charging E.P.T., £108,643 (£101,442); net profit, after £50,000 (same) to income tax reserve, £47,582 (£42,394); general reserve, £50,000 (nil); dividend of 8% (same) and bonus of 5% (same) from capital reserve; forward, £66,364 (£85,570).

British Aluminium Company—Trading profit for 1946 (including income from subsidiary and allied companies) after provision for E.P.T. reduced by deferred repairs claims, and after additional reserve for fluctuations in stock prices, £1,364,412 (£753,944); interest on deposits and dividends on investments, £3,145 (£19,053); transfer fees, £538 (£443); estimated E.P.T. refund, nil (£246,000); to directors' fees, £20,750 (£18,615); provision for income-tax based on profits of the year (less reduction for initial allowances, £455,000 (£456,000); additional provision for income-tax arising on reduction of E.P.T. liabilities in respect of deferred repairs, £130,000 (nil); debenture stock service fund, £175,000 (same); depreciation, £140,000 (£75,000); general reserve, £200,000 (£125,000); staff superannuation fund, £10,000 (nil); preference dividend, £90 000 (same); final ordinary dividend of 8%, making 10% (8%); forward, £308,361 (£285,516).

Obituary

MR. REGINALD WILLIAM BILES, chairman of the Institution of Electrical Engineers, Western Centre, died at Bristol on March 30.

MR. ARTHUR PARKES, commercial manager of the Tees Side Bridge & Engineering Works, Limited, died recently. He had been with the company for 35 years.

MR. WILLIAM JOHN LOVE, who died on March 30, aged 83, was formerly managing director and chairman of the L.E.B. Engineering Company, Limited, London, N.1.

MR. ANDREW WILLIAM HEWISH, for over 30 years London representative of D. F. Tayler & Company, Limited, metal rollers and wire drawers, of Tipton, Staffs, has died at the age of 85. He was associated with the company for 73 years.

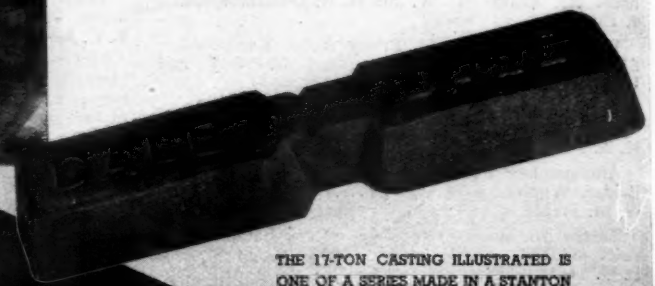
MR. ROBERT CLARK, governing director of John Tinsley, Limited, mining machinery manufacturers, etc., of Darlington, died on March 20. He was managing director from the formation of the company in 1906 until recently, when he was appointed governing director.

Tin Buying Prices Increased

New buying prices for Malayan tin metal and Nigerian tin concentrates, effective from April 2 until further notice, have been announced by the Ministry of Supply. That for Malayan metal is increased from £370 to £423 a ton at smelters' works, and that for Nigerian concentrates from £357 10s. to £405 15s. a ton of tin in ore, f.a.s. Nigerian port. The selling price of Malayan metal is raised to £426.

STANTON-DALE
REFINED PIG IRON

Manufactured to guaranteed analyses in seven standard grades. Also obtainable to individual specification



THE 17-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON

1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit

The
STANTON IRONWORKS
COMPANY LIMITED
NEAR NOTTINGHAM

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Frank Bucknall, Greenroof, Ashtead Station, Surrey—Ironmasters, founders, etc. £1,000.

Epsom Engineering (1947), Ling House, 10-13, Dominion Street, London, E.C.2—£1,000.

Bondex, 15-16, King Street, Wolverhampton—Ironmasters, engineers, etc. £1,000. W. E. Dunn.

N. E. Webster & Sons—Engineers, etc. £5,000. C. A. Tingey, 87, Fargate, Sheffield, subscriber.

Reliance Engineers (Leamington), 44, Oxford Street, Leamington Spa—£5,000. A. J. Barnes and J. D. Prince.

Vice & King, 21, Blakehouse Lane, Leicester—Engineers, etc. £1,000. H. W. and H. H. Donisthorpe, and J. Corner.

Wray's (Engineers), 83, Priory Road, Kenilworth—£20,000. J. C. Blakeman, A. and G. Wray, and B. V. Davis.

Owen & Foster, 3, Mather Road, Eccles, near Manchester—General engineers. £1,000. R. Owen and K. A. Foster.

Amalgamated Production Engineers, 22, Wimbledon Bridge, Wimbledon, London, S.W.19—£1,000. E. and G. M. Preece.

Textile Machines (Syston), 23, School Lane, Syston, Leics—£1,000. H. W. and H. H. Donisthorpe, and E. F. Howard.

J. H. Robinson & Sons, 54, Bromley High Street, London, E.2—Founders, metal dealers, etc. £30,000. A. J. and A. E. Stokes.

H. G. Barnard Passmore & Company, 10-11, Lime Street, London, E.C.3—Metal merchants. £5,000. H. G. and R. Barnard.

Textomatics, Albert Street, Mill Hill, Blackburn—Manufacturers of textile machinery, etc. £1,000. H. Lakeland and J. Baines.

Barand—Manufacturers of engineers' requisites, etc. £1,000. H. Anderson, High Winds, Bridle Road, Maidenhead, subscriber.

Brimsdown Castings Company, Stockingswater Lane, Brimsdown, Mdx—Metal founders, engineers, etc. £5,000. S. and B. Beatty.

Acres (Willington), 41, St. Mary's Gate, Derby—Agricultural engineers, etc. £3,000. F. Fryer, F. W. Clayton and A. R. Collins.

Chosen Products, 108, Brompton Road, London, W.1—Engineers, founders, etc. £1,000. F. A. I. Moleyns and H. Y. Willis.

Kenleys, Standard House, 52-54, Grays Inn Road, London, W.C.1—Dealers in metals and metal products, etc. £20,000. B. Brahams.

Dazip Products, 147, Kensal Road, London, W.10—Mechanical and general engineers, etc. £1,000. G. S. Charnock and G. C. Booth.

Brettell Lane Foundry, Lanwill Works, Silver Street, Brierley Hill—£15,000. J. S. Lane, S. C. Elcock, and W. H. and S. P. Chambers.

B. Bird & Company, Tividale, Tipton, Staffs—Manufacturers of boiler and steam-raising plant and machinery, etc. £2,000. B. and L. Bird.

Powell Engineering Company, Idaho, Admiral Road, Park Gate, near Southampton—£1,000. H. W. Powell and F. V. F. Temple-Gore-Langton.

Midgley & Sutcliffe—Machine-tool manufacturers and general engineers. £50,000. W. Hildreth, 80, North Park Avenue, Leeds, 8, subscriber.

Whittome (Tavistock), 3, Parkwood Road, Tavistock, Devon—General and agricultural engineers, etc. £10,000. C. H. Knapman and G. J. White.

Elrow, Waterloo Engineering Works, Gorsey Mount Street, Stockport—Millwrights, engineers, etc. £2,000. L. C. Row, C. S. and N. Youatt, and F. J. Samtelle.

McGeorge & Partners, 82, South Audley Street, London, W.1—Buyers and sellers of plant, machinery, tools, etc. £2,000. C. R. Allday, and W. and J. D. McGeorge.

Bee Appliances, Sunnybank Farm, Hambleton, Lancs.—Manufacturers of mechanical, electrical, agricultural and other machinery, etc. £5,000. J. Bee, M. Cooper and S. Seed.

Sheetfabs (Nottingham), 168, Regent Street, Beeston, Nottingham—Constructional engineers, sheet-metal workers, etc. £5,000. L. G. Herrod, A. Sheen and P. O. Patrick.

Caulfield Holland, West Road, Portslade, Sussex—Electrical and general engineers, etc. £62,000. L. Holland, E. Baring-Harwood, R. O. C. Siffleet, G. J. P. Holloway, and H. P. Hay.

Hardy & Ward, Wellington Works, Denton Road, Audenshaw, near Manchester—Iron and brass founders, engineers, etc. £1,000. J. Dunning, T. Mitchell, H. Hardy, A. Wilson, and J. P. Ashworth.

Platt Bros. (Sales), Hartford Works, Oldham—Textile-machinery merchants, etc. £10,000. J. Redman, S. H. L. Greaves, H. A. H. McGill, H. H. Vlies, B. A. P. Dobson, H. A. MacKay, and R. Chiles.

Aberdeen Precision Engineering Company, 208, Market Street, Aberdeen—To acquire business carried on by Colin C. Foster at Wellington Street, Aberdeen. £5,000. C. C. Foster, A. Angus, and E. Webster.

A. W. Sutton & Company, Forward Works, Eagle Street, Wolverhampton—General stampers and drop forgings, steam and hydraulic flanges, etc. £30,000. A. W., G. A. and H. W. Sutton, and H. V. C. Butler.

Stilwell & Company (Guildford), Middleton Road, By-Pass Road, Guildford, Surrey—Mechanical and constructional engineers, etc. £1,000. W. G. Stilwell, J. H. Anderson, C. T. Maynard, and A. G. Peacock.

FURNACE LINING ECONOMY BEGINS

That G.R. products are widely used because they can be depended upon to provide strong, stable and lasting furnace structures and linings, is due to the foresight and the exceptional care taken in manufacture, development and research. Whether Basic, Silica, Fireclay or any other type of refractory material, the G.R. range is so wide that the correct choice is always possible. Each type is designed to meet specific furnace requirements; manufacturing processes employing the latest in plant and equipment are developed to maintain uniform quality at standards which G.R. research maintains at the highest level of efficiency. These activities are all directed by a comprehensive practical knowledge of furnace conditions. That is why for the finest refractories and sound technical assistance it always pays to consult G.R.

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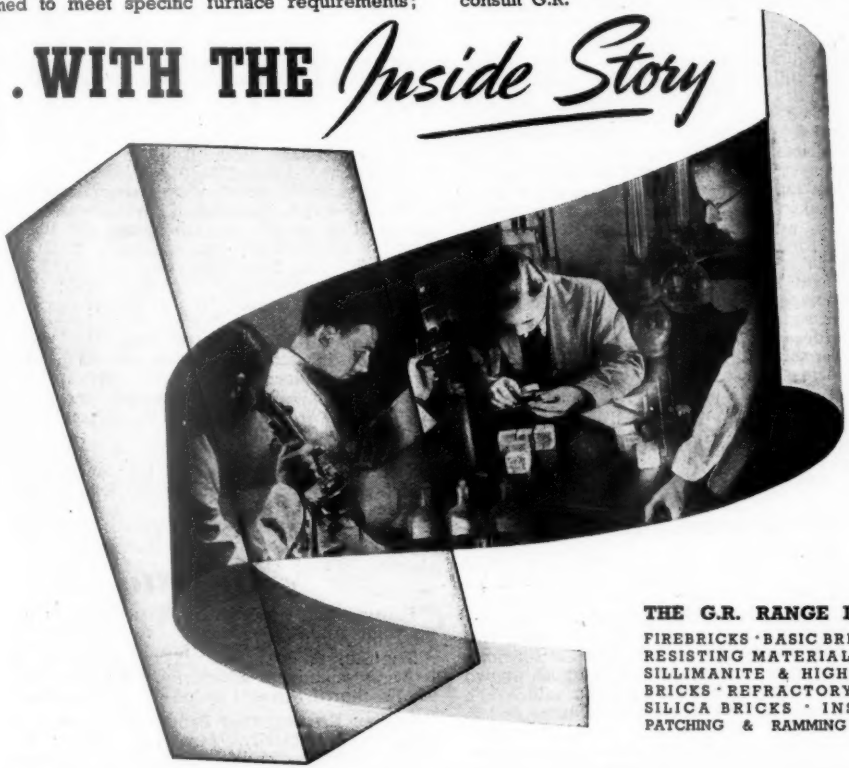

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194

Raw Material Markets

Iron and Steel

All foundries continue to be extremely busy and many users of light castings are having the utmost difficulty in placing further business. Large quantities of iron of varying types are necessary to meet present requirements, but the position in certain directions is by no means reassuring. Stocks both at the furnaces and the foundries are meagre. It is unlikely that larger supplies of foundry iron will become available for some time owing to the heavy pressure for basic iron for steelmaking. The general engineering and speciality foundries are very active, and are pressing for large quantities of iron. Bigger tonnages of scrap are now being utilised to help out the pig-iron position.

There continues to be a steady demand for most grades of finished iron. Best bars for the heavy industries are under pressure. Users of No. 3 and No. 4 iron have sent their orders to the makers covering supplies for the next few months, and recently there has been a distinct improvement in the demand for crown bars. The makers would like to see a freer flow of scrap, but they are reasonably well situated in regard to supplies of forge pig-iron.

Re-rollers have very heavy commitments for sheets, strip, bars, light structural sections, etc., but, unfortunately, the output is not at the maximum level owing to inadequate supplies of semi-finished raw materials. This position does not apply so much to the sheet trade as to the other sections, the supply of sheet bars to the sheet mills being satisfactory. Rollers of bars, however, are very short of billets and blooms; although some imported material is arriving and considerable quantities are coming from home sources, the tonnage falls well below actual needs.

Non-ferrous Metals

With the Easter holidays over, it is possible to obtain a clearer picture of market reactions to the recent increases in the prices of copper, lead and tin. The rise of £20 in the price of lead caused considerable surprise, as the maximum increase expected in this metal was £15. Lead now has a price of £90, which is six times the pre-war value, whereas copper only stands at two and a half, and zinc four times the pre-war value. The increase of £10 in the price of copper was more or less what was expected. Scrap prices have, of course, advanced in line with the increases in copper and lead. The supply position for copper appears to be fairly good. In the case of lead, the outlook is poor. Although there would seem to be a slight improvement in the United States, there has been no change in the supply position in this country. Remelted lead and scrap are not too plentiful and prices are firm. Scrap merchants are reported to be exercising the greatest care over purchases. Evidently they feel that there are considerable risks in the situation as it stands at present.

Non-ferrous Scrap Metal Prices

Revised List of Quotations

The following prices of non-ferrous scrap metals have been announced by the Ministry of Supply. The prices are for scrap metal at Ministry of Supply depots at which the Minister is prepared to effect a sale to a buyer subject to having sufficient material of that particular quantity available at a convenient depot at any particular time. The list refers to delivery within the current and next three calendar months, but is published without prejudice or commitment. Without notice the schedule of materials may be amended in the light of changing circumstances, and prices may be altered in accordance with market conditions, production costs and other factors. Publication of the prices does not constitute an offer of sale. The following prices are per ton, ex-works:—

COPPER—Clean, untinned, cut up, £129; shell-band scrap (other than turnings), £129; copper turnings (including shell-band turnings), £117.

ZINC—Zinc scrap, £58 10s.

ZINC ALLOY—Zinc alloy die-cast scrap, £65.

BRASS—S.A.A. webbing, £106; defective cups and cases, £105; cut-offs and trimmings, £99 10s.; muffled and/or mechanically treated cases, £102; turnings, loose, £91 10s.; fired Q.F. cases, £107; Q.F. webbing, £107; Q.F. cut-offs and trimmings, £105; Q.F. defective cups and cases, £107; Q.F. turnings, £92 10s.; other 70/30 process and manufacturing scrap, £103 10s.; 60/40 rod swarf, £83 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. copper, £98; broken down fuse scrap, 60/40, £94; 90/10 gilding metal webbing, £120 10s.; 90/10 gilding metal defective cups and envelopes before filling, £118.

Scrap gilding metal bullet envelopes (max. antimonial lead content, 4 per cent.), £104 10s.; scrap cupro-nickel bullet envelopes (max. antimonial lead content, 0.08 per cent.) £120.

Gazette

FROME CASTINGS COMPANY, LIMITED, is being wound up voluntarily.

THE SHIP & BOAT BUILDERS' ASSOCIATION, LIMITED, is being wound up voluntarily. Mr. F. St. J. North, 99, Fenchurch Street, London, is the liquidator.

STUDEX ENGINEEERING PRODUCTS, LIMITED, is being wound up voluntarily. Mr. C. H. Palmer, 5, Throgmorton Avenue, London, E.C.2, is the liquidator.

C.S.M. ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. J. K. Morgan, 68-72, Horseferry Road, Westminster, London, S.W.1, is the liquidator.

THE PARTNERSHIP BETWEEN James and Alfred Radford and Hugh Flynn, under the style of Radflyn Engineering Company, Thatcham, Berks, has been dissolved by mutual consent.